Listing of the Claims

1. (Currently Amended) A reset circuit for an integrating amplifier, including:

first comparator circuitry having a first input terminal, a second input terminal and a first output terminal;

a first conductive path adapted to couple the first input terminal to a feedback loop of an integrating amplifier between an integrator output of the integrating amplifier and an integrating capacitor along the feedback loop, whereby a comparator input voltage at the first input terminal is changed in a predetermined first direction and in proportion to an amplitude of an incoming current during integration of the incoming current;

a substantially stable first voltage source for biasing the second input terminal at a first threshold voltage level selected to determine one end of an operating range for integration, wherein the ~~first~~ comparator input voltage, when in said range and when so changed during integration, approaches the first threshold voltage level; and

a second conductive path coupling the first output terminal to the feedback loop;

wherein the first comparator circuitry is adapted, in response to detecting movement of the comparator input voltage out of the operating range beyond the first threshold voltage level, to generate a predetermined first comparator output voltage level at the first output terminal and to apply the first comparator output voltage level to the feedback loop via the second conductive path, thereby to drive the comparator input voltage in a second direction opposite said first direction to a point within the operating range for further integration of the incoming current; and

wherein the first comparator circuitry further is adapted to stop the application of the first comparator output voltage level to the feedback loop, responsive to detecting movement of the comparator input voltage, during said application, in the second direction beyond the first threshold voltage level and into the operating range.

2. (Cancelled)

3. (Currently Amended) The circuit of claim 1 further including:

an RC network along the first conductive path for interposing a time delay between a given change in voltage at the integrator output ~~the voltage~~ and a corresponding change in the comparator input voltage at the first input terminal.

4. (Previously Presented) The circuit of claim 1 further including:

second comparator circuitry having a third input terminal, a fourth input terminal and a second output terminal, wherein the third input terminal is coupled to receive the comparator input voltage;

a substantially stable second voltage source for biasing the fourth input terminal at a second threshold voltage level selected to determine a second and opposite end of the operating range, wherein the comparator input voltage, when in the operating range and when driven in said opposite direction, moves toward the second threshold voltage level; and

a third conductive path adapted to couple the second output terminal to the feedback loop;

wherein the second comparator circuitry is adapted, in response to detecting movement of the comparator input voltage in the second direction out of the operating range beyond the second threshold voltage level, to generate a predetermined second comparator output voltage level at the second output terminal and to apply the second comparator output voltage level to the feedback loop via the third conductive path, thereby to drive the comparator input voltage in the first direction to a point within the operating range for further integration of the incoming current.

5. (Previously Presented) The circuit of claim 1 wherein:

the comparator input voltage, when in the operating range, is higher than the first threshold voltage level, and is reduced during integration of the incoming current.

6. (Previously Presented) The circuit of claim 5 wherein:

the substantially stable first comparator output voltage level is a high voltage selected to rapidly charge the integrating capacitor.

7. (Previously Presented) The circuit of claim 6 wherein:

the first comparator circuitry is adapted to alternatively generate said high voltage and a substantially stable low voltage, wherein applying the first comparator output voltage to the feedback loop consists essentially of switching from the low voltage to the high voltage, and stopping the application to the feedback loop consists essentially of switching from the high voltage to the low voltage.

8. (Previously Presented) The circuit of claim 7 further including:

power control circuitry having a fifth input terminal coupled to the first output terminal, a third output terminal, and a fourth conductive path adapted to couple the third output terminal to an input of the integrating amplifier to provide power to the integrating amplifier;

wherein the power control circuitry is adapted to generate a substantially stable high voltage during integration, and to switch from the high voltage to a substantially stable low voltage in response to receiving the high voltage from first comparator circuitry, thereby to shut off power to the integrating amplifier.

9. (Previously Presented) The circuit of claim 6 further including:

a diode along the second conductive path, oriented with its forward direction coincident with current flow from the first output terminal to the feedback loop.

10. (Previously Presented) The circuit of claim 6 further including:

limiting circuitry coupled to the second conductive path to prevent excess charging of the integrating capacitor.

11. (Previously Presented) The circuit of claim 10 wherein:

the limiting circuit includes a limiting capacitor coupled to be charged simultaneously with charging of the integrating capacitor, and a diode biased to a substantially stable limiting voltage level.

12. (Previously Presented) The circuit of claim 4 wherein:

the comparator input voltage, when in the operating range, is higher than the first threshold voltage level, and lower than the second threshold voltage level, and is reduced during integration of the incoming current.

13. (Previously Presented) The circuit of claim 12 wherein:

the first comparator circuitry is adapted to alternatively generate a substantially stable high voltage and a substantially stable low voltage at the first output terminal, and generating the first comparator output voltage level consists essentially of switching from the low voltage to the high voltage to rapidly charge the integrating capacitor.

14. (Previously Presented) The circuit of claim 13 wherein:

the second comparator circuitry is adapted to alternatively generate a substantially stable high voltage and a substantially stable low voltage at the second output terminal, and generating the second comparator output level consists essentially of switching from the high voltage to the low voltage to rapidly discharge the integrating capacitor.

15. (Previously Presented) The circuit of claim 14 further including:

power control circuitry having a fifth input terminal coupled to the first output terminal, a third output terminal, and a fourth conductive path adapted to couple the third output terminal to an input of the integrating amplifier to provide power to the integrating amplifier;

wherein the power control circuitry is adapted to generate a substantially stable high voltage during integration, and to switch from the high voltage to a substantially stable low voltage in response to receiving the high voltage from the first comparator circuitry, thereby to shut off power to the integrating amplifier.

16. (Previously Presented) The circuit of claim 15 wherein:

the power control circuit comprises an operational amplifier with a positive input terminal biased at a substantially stable voltage and a negative input terminal coupled to the first output terminal, and each of the first and second comparator circuitry comprises an operational amplifier with resistive feedback receiving the first comparator input voltage at a negative input terminal.

17-61 (Cancelled)

62. (New) An integrating amplifier circuit, including:

an integrator comprising an integrating amplifier having an integrator input for receiving an incoming current and a power input for receiving power, and adapted to integrate the

incoming current to generate an integrator output voltage at an integrator output; and a feedback loop from the integrator output to the integrator input;

first comparator circuitry having a first input terminal, a second input terminal and a first output terminal;

a first conductive path adapted to couple the first input terminal to the feedback loop between the integrator output and an integrating capacitor along the feedback loop, whereby a comparator input voltage at the first input terminal is changed in a predetermined first direction and in proportion to an amplitude of the incoming current during integration of the incoming current;

a substantially stable first voltage source for biasing the second input terminal at a first threshold voltage level selected to determine one end of an operating range for integration, wherein the comparator input voltage, when in said range and when so changed during integration, approaches the first threshold voltage level;

a second conductive path coupling the first output terminal to the feedback loop; and

power control circuitry having a third input terminal coupled to the first output terminal, a third output terminal, and a third conductive path coupling the third output terminal to the power input, and adapted to generate a substantially stable high voltage during integration to provide power to the integrating amplifier;

wherein the first comparator circuitry is adapted, in response to detecting movement of the comparator input voltage out of the operating range beyond the first threshold voltage level, to apply a predetermined first comparator output voltage level to the third input terminal and to the feedback loop via the second conductive path, thereby to drive the comparator input voltage in a second direction opposite said first direction to a point within the operating range for further integration of the incoming current; and

wherein the power control circuitry further is adapted, in response to receiving the first comparator output voltage level at the third input terminal, to shut off power to the integrating amplifier.

63. (New) The circuit of claim 62 wherein:

the first comparator circuitry further is adapted to stop the application of the first comparator output voltage level to the feedback loop, responsive to detecting movement of the comparator input voltage, during said application, in the second direction beyond the first threshold voltage level and into the operating range.

64. The circuit of claim 62 wherein:

the power control circuitry is adapted to shut off power to the integrating amplifier by switching from the high voltage to a substantially stable low voltage in response to receiving the first comparator output voltage level.

65. (New) The circuit of claim 62 further including:

an RC network along the first conductive path for interposing a time delay between a given change in the integrator output the voltage and a corresponding change in the comparator input voltage at the first input terminal.

66. (New) The circuit of claim 62 further including:

second comparator circuitry having a fourth input terminal, a fifth input terminal and a second output terminal, wherein the fourth input terminal is coupled to receive the comparator input voltage;

a substantially stable second voltage source for biasing the fifth input terminal at a second threshold voltage level selected to determine a second and opposite end of the operating range, wherein the comparator input voltage, when in the operating range and when driven in said opposite direction, moves toward the second threshold voltage level; and

a third conductive path adapted to couple the second output terminal to the feedback loop;

wherein the second comparator circuitry is adapted, in response to detecting movement of the comparator input voltage in the second direction out of the operating range beyond the second threshold voltage level, to generate a predetermined second comparator output voltage level at the second output terminal and to apply the second comparator output voltage level to the feedback loop via the third conductive path, thereby to drive the comparator input voltage in the

first direction to a point within the operating range for further integration of the incoming current.

67. (New) The circuit of claim 62 wherein:

the comparator input voltage, when in the operating range, is higher than the first threshold voltage level, and is reduced during integration of the incoming current.

68. (New) The circuit of claim 67 wherein:

the substantially stable first comparator output voltage level is a high voltage selected to rapidly charge the integrating capacitor.

69. (New) The circuit of claim 68 wherein:

the first comparator circuitry is adapted to alternatively generate said high voltage and a substantially stable low voltage, wherein applying the first comparator output voltage to the feedback loop consists essentially of switching from the low voltage to the high voltage, and stopping the application to the feedback loop consists essentially of switching from the high voltage to the low voltage.

70. (New) The circuit of claim 68 further including:

a diode along the second conductive path, oriented with its forward direction coincident with current flow from the first output terminal to the feedback loop.

71. (New) The circuit of claim 68 further including:

limiting circuitry coupled to the second conductive path to prevent excess charging of the integrating capacitor.

72. (New) The circuit of claim 71 wherein:

the limiting circuit includes a limiting capacitor coupled to be charged simultaneously with charging of the integrating capacitor, and a diode biased to a substantially stable limiting voltage level.

73. (New) The circuit of claim 62 further including:

a differentiator coupled to the integrator output to receive the integrator output voltage, and adapted to differentiate the integrator output voltage to provide a differentiator output proportional to the incoming current.

74. (New) A current measuring circuit, including:

an integrator comprising an integrating amplifier having an integrator input for receiving an incoming current and adapted to integrate the incoming current to generate an integrator output voltage at an integrator output, and a feedback loop from the integrator output to the integrator input;

first comparator circuitry having a first input terminal, a second input terminal and a first output terminal;

a first conductive path adapted to couple the first input terminal to the feedback loop between the integrator output and an integrating capacitor along the feedback loop, whereby a comparator input voltage at the first input terminal is changed in a predetermined first direction and in proportion to an amplitude of an incoming current during integration of the incoming current;

a substantially stable first voltage source for biasing the second input terminal at a first threshold voltage level selected to determine one end of an operating range for integration, wherein the comparator input voltage, when in said range and when so changed during integration, approaches the first threshold voltage level;

a second conductive path coupling the first output terminal to the feedback loop; and

a differentiator coupled to the integrator output to receive the integrator output voltage, and adapted to differentiate the integrator output voltage to provide a differentiator output proportional to the incoming current;

wherein the first comparator circuitry is adapted, in response to detecting movement of the comparator input voltage out of the operating range beyond the first threshold voltage level, to apply a predetermined first comparator output voltage level to the feedback loop via the second conductive path, thereby to drive the comparator input voltage in a second direction

opposite said first direction to a point within the operating range for further integration of the incoming current.

75. (New) The circuit of claim 74 wherein:

said component comprises an A/D converter and a digital processor coupled to receive an output of the A/D converter adapted to generate values proportional to the incoming current.

76. (New) The circuit of claim 74 wherein:

wherein the first comparator circuitry further is adapted to stop the application of the first comparator output voltage level to the feedback loop, responsive to detecting movement of the comparator input voltage, during said application, in the second direction beyond the first threshold voltage level and into the operating range.

77. (New) The circuit of claim 74 further including:

an RC network along the first conductive path for interposing a time delay between a given change in the integrator output the voltage and a corresponding change in the comparator input voltage at the first input terminal.

78. (New) The circuit of claim 76 further including:

second comparator circuitry having a third input terminal, a fourth input terminal and a second output terminal, wherein the third input terminal is coupled to receive the comparator input voltage;

a substantially stable second voltage source for biasing the fourth input terminal at a second threshold voltage level selected to determine a second and opposite end of the operating range, wherein the comparator input voltage, when in the operating range and when driven in said opposite direction, moves toward the second threshold voltage level; and

a third conductive path adapted to couple the second output terminal to the feedback loop;

wherein the second comparator circuitry is adapted, in response to detecting movement of the comparator input voltage in the second direction out of the operating range beyond the second threshold voltage level, to apply a predetermined second comparator output voltage level to the feedback loop via the third conductive path, thereby to drive the comparator input voltage

in the first direction to a point within the operating range for further integration of the incoming current.

79. (New) The circuit of claim 74 wherein:

the comparator input voltage, when in the operating range, is higher than the first threshold voltage level, and is reduced during integration of the incoming current.

80. (New) The circuit of claim 79 wherein:

the substantially stable first comparator output voltage level is a high voltage selected to rapidly charge the integrating capacitor.

81. (New) The circuit of claim 80 wherein:

the first comparator circuitry is adapted to alternatively generate said high voltage and a substantially stable low voltage, wherein applying the first comparator output voltage to the feedback loop consists essentially of switching from the low voltage to the high voltage, and stopping the application to the feedback loop consists essentially of switching from the high voltage to the low voltage.

82. (New) The circuit of claim 81 further including:

power control circuitry having a fifth input terminal coupled to the first output terminal, a third output terminal, and a fourth conductive path adapted to couple the third output terminal to an input of the integrating amplifier to provide power to the integrating amplifier;

wherein the power control circuitry is adapted to generate a substantially stable high voltage during integration, and to switch from the high voltage to a substantially stable low voltage in response to receiving the high voltage from first comparator circuitry, thereby to shut off power to the integrating amplifier.

83. (New) The circuit of claim 80 further including:

a diode along the second conductive path, oriented with its forward direction coincident with current flow from the first output terminal to the feedback loop.

84. (New) The circuit of claim 80 further including:

limiting circuitry coupled to the second conductive path to prevent excess charging of the integrating capacitor.

85. (New) The circuit of claim 84 wherein:

the limiting circuit includes a limiting capacitor coupled to be charged simultaneously with charging of the integrating capacitor, and a diode biased to a substantially stable limiting voltage level.

86. (New) An integrator circuit, including:

an integrator comprising an integrating amplifier having an integrator input for receiving an incoming current and adapted to integrate the incoming current to generate an integrator output voltage at an integrator output, and a feedback loop from the integrator output to the integrator input;

first comparator circuitry having a first input terminal, a second input terminal and a first output terminal, adapted to alternatively generate predetermined first and second steady–state comparator output voltage levels;

a first conductive path adapted to couple the first input terminal to the feedback loop between the integrator output and an integrating capacitor along the feedback loop, whereby a comparator input voltage at the first input terminal is changed in a predetermined first direction and in proportion to an amplitude of an incoming current during integration of the incoming current;

a substantially stable first voltage source for biasing the second input terminal at a first threshold voltage level selected to determine one end of an operating range for integration, wherein the comparator input voltage, when in said range and when so changed during integration, approaches the first threshold voltage level; and

a second conductive path coupling the first output terminal to the feedback loop;

wherein the first comparator circuitry is adapted, in response to detecting movement of the comparator input voltage out of the operating range beyond the first threshold voltage level, to apply the first steady-state comparator output voltage level to the feedback loop via the second

conductive path, thereby to drive the comparator input voltage in a second direction opposite said first direction to a point within the operating range for further integration of the incoming current.

87. (New) The circuit of claim 86 wherein:

the first comparator circuitry further is adapted to switch to and apply the second comparator output voltage level to the feedback loop, responsive to detecting movement of the comparator input voltage, during said application, in the second direction beyond the first threshold voltage level and into the operating range.

88. (New) The circuit of claim 86 further including:

an RC network along the first conductive path for interposing a time delay between a given change in the integrator output the voltage and a corresponding change in the comparator input voltage at the first input terminal.

89. (New) The circuit of claim 86 further including:

second comparator circuitry having a third input terminal, a fourth input terminal and a second output terminal, wherein the third input terminal is coupled to receive the comparator input voltage;

a substantially stable second voltage source for biasing the fourth input terminal at a second threshold voltage level selected to determine a second and opposite end of the operating range, wherein the comparator input voltage, when in the operating range and when driven in said opposite direction, moves toward the second threshold voltage level; and

a third conductive path adapted to couple the second output terminal to the feedback loop;

wherein the second comparator circuitry is adapted, in response to detecting movement of the comparator input voltage in the second direction out of the operating range beyond the second threshold voltage level, to generate a predetermined second comparator output voltage level at the second output terminal and to apply the second comparator output voltage level to the feedback loop via the third conductive path, thereby to drive the comparator input voltage in the first direction to a point within the operating range for further integration of the incoming current.

90. (New) The circuit of claim 86 wherein:

the comparator input voltage, when in the operating range, is higher than the first threshold voltage level, and is reduced during integration of the incoming current.

91. (New) The circuit of claim 90 wherein:

the substantially stable first comparator output voltage level is a high voltage selected to rapidly charge the integrating capacitor.

92. (New) The circuit of claim 91 wherein:

the first comparator circuitry is adapted to alternatively generate said high voltage and a substantially stable low voltage, wherein applying the first comparator output voltage to the feedback loop consists essentially of switching from the low voltage to the high voltage, and stopping the application to the feedback loop consists essentially of switching from the high voltage to the low voltage.

93. (New) The circuit of claim 92 further including:

power control circuitry having a fifth input terminal coupled to the first output terminal, a third output terminal, and a fourth conductive path adapted to couple the third output terminal to an input of the integrating amplifier to provide power to the integrating amplifier;

wherein the power control circuitry is adapted to generate a substantially stable high voltage during integration, and to switch from the high voltage to a substantially stable low voltage in response to receiving the high voltage from first comparator circuitry, thereby to shut off power to the integrating amplifier.

94. (New) The circuit of claim 91 further including:

a diode along the second conductive path, oriented with its forward direction coincident with current flow from the first output terminal to the feedback loop.

95. (New) The circuit of claim 91 further including:

limiting circuitry coupled to the second conductive path to prevent excess charging of the integrating capacitor.

96. (New) The circuit of claim 95 wherein:

the limiting circuit includes a limiting capacitor coupled to be charged simultaneously with charging of the integrating capacitor, and a diode biased to a substantially stable limiting voltage level.

97. (New) The circuit of claim 86 further including:

a differentiator coupled to the integrator output to receive the integrator output voltage, and adapted to differentiate the integrator output voltage to provide a differentiator output proportional to the incoming current.